Rec. zool. Surv. India: Vol. 122(1)/83–90, 2022
DOI: 10.26515/rzsi/v122/i1/2022/163936

ISSN (Online) : 2581-8686
ISSN (Print) : 0375-1511

Ant diversity of an urban garden with a new record from India

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Abstract

A total of fifty ant species belonging to twenty-nine genera and six subfamilies were collected from the Agri-Horticultural of India, an urban garden situated in Kolkata, West Bengal, India. Seven species viz., *Leptogenys hysterica* Forel, 1900, Lophomyrmex birmanus Emery, 1893, *Nylanderia birmana* (Forel, 1902), *Plagiolepis exigua* Forel, 1894, *Plagiolepis pissina* Roger, 1863 *Temnothorax schurri* (Forel, 1902) and *Tetraponera aitkenii* (Forel, 1902) are reported for the first time from the state West Bengal. Out of which *Plagiolepis pissina* is recorded here for the first time from India, which was previously reported from Sri Lanka and the genus *Temnothorax* Mayr, 1861, first record from the Indian state West Bengal. Among the ants *Monomorium* found to be the most diverse genus consisting five species (*M. atomum* Forel, 1902, *M. dichroum* Forel, 1902, *M. floricola* (Jerdon, 1851), *M. monomorium* Bolton, 1987 and *M. orientale* Mayr, 1879) from the area.

Keywords: Ants, Agri-Horticultural Society of India, *Plagiolepis pissina*, West Bengal

Introduction

Ants are one of the most diverse groups of insects belonging to the family Formicidae (Hymenoptera). It comprises about 16,516 valid species and subspecies (California Academy of Science, 2021). They are present almost in all the ecosystems and they occupy 15-25% of the terrestrial animal biomass (Schultz, 2000). They spread in all ecological niches and live in a wide range of habitats. They play an important role in the ecosystem as they act as predator, prey, scavenger, pollinator, seed disperser and much more. They are a good indicator of ecosystem health as they are sensitive to environmental changes (Anderson *et al*., 2002). Ants along with earthworms and termites are considered the main soil engineers (Lavelle *et al*., 1997; Folgarait,1998). Ants are a very good model for taxonomic and ecological study but irrespective of their great importance there are not many studies in India, especially in urban areas. Our present study was based on an urban garden in Kolkata.

The Agri Horticultural Society of India is rich in a variety of flora like 250 varieties of roses, 56 different types of orchids, different medicinal, herbal and xerophytic plants. The society also possesses different kinds of fauna like birds, butterflies and a few species of mammals. There is no previous study about ants in this place. The aim of the present study is to document the ant diversity in the study area.

Materials and Methods

Study Area

The Agri Horticultural Society of India (Latitude 22°31'41"N; longitude 88°20'57" E consists of 24 acres of land in which garden and planted area occupy 77.7% while water bodies remain in 4.4% area (Basu, Datta and Mitra, 2020). This lush green area not only provides a suitable environment for different ecological communities but it acts as a lung in an urban habitat which helps to maintain an ecological balance in this metropolitan city. Yearly flower shows, different kinds of research activities and training programs are being organized frequently in this society. Apart from this, various anthropogenic activities are common in this area as people find this place very soothing and peaceful in this bustling city. Members of the society come to this place for their morning and

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Article Received on: 09.06.2021 Accepted on: 02.05.2022

evening walk and in this area a small park is present especially dedicated to children.

Study Period

The study was conducted from July 2019 to December 2020. Ants were collected from morning to afternoon between 8:30 a.m. to 4:30 p.m.

Collection Methods

Ants were collected mostly by hand picking method. Sometimes baits like sugar, honey, biscuit, banana, and boiled egg were also kept on the ground to attract ants. Ants were collected from the soil surface, leaf litter, tree trunks, different parts of plants (leaves, flowers, buds), as well as different kinds of nests like soil nests, arboreal nests,etc with the help of forceps and soft brush soaked with alcohol and kept them in vials containing 70% alcohol. After collection, sorting and identification were done by using standard literature like keys provided by Bolton (1994) and Bingham (1903). Leica S8AP0 microscope was used for ant identification and for field photography Nikon D5600 camera was used.

Result

During the study period, we found 50 ant species (Table 1) belonging to six subfamilies- Dolichoderinae, Dorylinae, Formicinae, Myrmicinae, Ponerinae and Pseudomyrmecinae. The highest diversity was shown by the subfamily Myrmicinae with twenty-five ant species represented by thirteen genera and the ants belonging to the genus *Monomorium* exhibited the highest diversity, represented by five species. Formicinae was the second diverse subfamily which consisted of thirteen species belonging to seven genera. Subfamily Ponerinae comprised seven species belonging to six genera while subfamily Pseudomyrmecinae occupied three species under one genus. Both Dolichoderinae and Dorylinae included one species and one genus. Out of fifty species, Seven species viz., *Leptogenys hysterica* Forel, 1900, *Lophomyrmex birmanus* Emery, 1893, *Nylanderia birmana* (Forel, 1902), *Plagiolepis exigua* Forel, 1894, *Plagiolepis pissina* Roger, 1863 *Temnothorax schurri* (Forel, 1902) and *Tetraponera aitkenii* (Forel, 1902) are reported for the first time from the state West Bengal. Out of which *Plagiolepis pissina* is recorded here for the first time from India, which was previously reported from Sri Lanka and the genus *Temnothorax* Mayr, 1861, first record from the Indian state West Bengal.

Seasonal Variation: The whole study period has been divided into four seasons that is Pre-Monsoon, Monsoon, Post-Monsoon and Winter. Ants that were found in all four seasons were designated as 'Common'. Ants that were encountered in two to three seasons were labelled as 'Repeated' while ants that were found only in one season that them as 'Rare'. It has been found that 12 ant species possess the title Common, 19 as Rare while 19 species of ant fall in the category of Repeated. Data shows that the post-Monsoon season is the most diverse (Found 68% of Ants species) while pre-Monsoon is less diverse as only 40% ants species were found (Figure 1).

Discussion

Subfamily Myrmicinae alone constitutes 50% of species of ants (Figure 2), this kind of dominance of Myrmicinae subfamily in an urban area was also found by Savitha

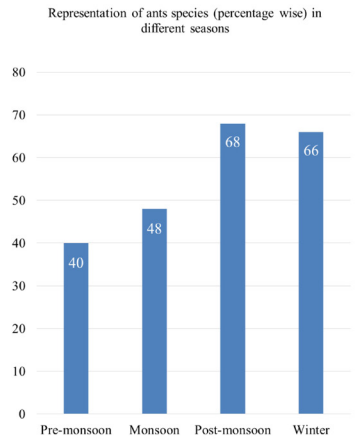

Figure 1. Seasonal Variation of ant species.

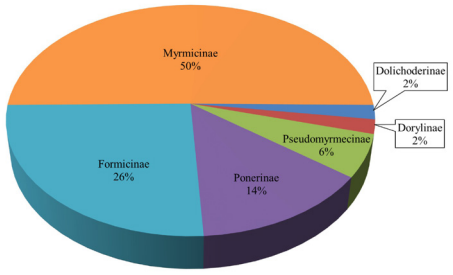

Figure 2. Percentage wise representation of ant subfamilies.

et al. (2008) at Bangalore, Kumar and Mishra (2008) at Vadodara, Khot, Quadros and Somani (2013) in Mumbai. It has been reported that *Lepisiota opaca* (Forel, 1892) remains in undisturbed areas and is rarely available in urban areas (Narendra and Kumar, 2006) but this species is common in the study area and found in all the seasons which is very significant. Common occurrence of *Tetraponera rufonigra* (Jerdon, 1851) and repeated presence of *Oecophylla smaragdina* (Fabricius, 1775) signifies that the area provides good habitat that is trees for both the arboreal species. *Lophomyrm exbirmanus* which is frequent in the society, makes their nest in the ground soil. They were interacting with aphids for honeydew secretion and it was also observed that they sucked the juice from different flowering plants like Ixora. *Leptogenys hysterica* which is reported for the first time from West Bengal was found only once in the damp soil ground cracks while *Plagiolepis pissina* which were very common in this place make their nest in the ground soil as well as in hard stony road.

It was found that ants like *Tapinoma, Pheidole parva* Mayr, 1865 were more drawn to boiled eggs rather than sweet items. *Solenopsis geminata* (Fabricius, 1804) was very aggressive its approach to capturing the food items and once it was observed that they drove away *Pheidole parva* Mayr, 1865 and grabbed the foodstuff. Genera *Pheidole, Solenopsis, Tapinoma* came to the bait as a colony while *Camponotus, Diacamma, Tetraponera* were mostly found foraging solitarily or at most two to three individuals came to the bait items.

Previously Tiwari *et al*. (1998) reported 28 species of ants from Kolkata, 29 species by Ghosh, Sheela and Kundu (2005), 20 species by Purkait (2017) and the ants which were common in all those previous studies as well as in this study are *Camponotus compressus* (Fabricius, 1787), *Paratrechina longicornis* and *Solenopsis geminata*. This study reveals that the study area is appropriate to host ants of different niche preference. Data shows the presence of ants that are highly adapted to disturbance: *Paratrechina longicornis* (Latreille, 1802) and *Camponotus compressus*; ants generally found in the undisturbed areas: *Lepisiota opaca*; general predators: *Lepisiota sericea* (Forel, 1892); excellent scavenger- *Myrmicaria brunnea* (Saunders, 1842), seed dispersers and trail makers: *Trichomyrmex*

Table 1. A Total List of 50 ant species collected from Agri-Horticultural Society of India. (FRI-First Record from India and FRWB-First record from West Bengal and '+' indicates presence of ant species while '-' indicates absence.)

Subfamily	Ant species	Occurrence	Pre-monsoon	Monsoon	Post-monsoon	Winter
Dolichoderinae	*Tapinoma indicum* Forel, 1895	Common	+	+	+	+
Dorylinae	*Lioponera longitarsus* (Mayr, 1879)(Figure 13)	Rare	-	-	-	+
Formicinae	*Anoplolepis gracilipes* (Smith, 1857)	Repeated	+	-	+	+
Formicinae	*Camponotus compressus* (Fabricius, 1787)	Rare	-	-	+	-
Formicinae	*Camponotus dolendus* Forel, 1892	Repeated	+	-	+	+
Formicinae	*Camponotus irritans* (Smith, 1857)	Repeated	-	+	+	+
Formicinae	*Camponotus parius* Emery, 1889	Common	+	+	+	+
Formicinae	*Lepisiota opaca* (Forel, 1892)	Common	+	+	+	+
Formicinae	*Lepisiota sericea* (Forel, 1892)	Repeated	+	-	+	+
Formicinae	*Nylanderia birmana* (Forel, 1902)(Figure 19)	Repeated (FRWB)	-	-	+	+

Subfamily	Ant species	Occurrence	Pre-monsoon	Monsoon	Post-monsoon	Winter
Formicinae	*Oecophylla smaragdina* (Fabricius, 1775)	Repeated	-	+	+	+
Formicinae	*Paratrechina longicornis* (Latreille, 1802)	Common	+	+	+	+
Formicinae	*Plagiolepis exigua* Forel, 1894 (Figure 20)	Repeated (FRWB)	-	+	+	+
Formicinae	*Plagiolepis pissina* Roger, 1863 (Figures 15-17)	Common (FRI)	+	+	+	+
Formicinae	*Plagiolepis* sp.	Rare	+	-	-	-
Myrmicinae	*Cardiocondyla* sp1.	Repeated	+	-	+	-
Myrmicinae	*Cardiocondyla* sp2.	Rare	-	-	+	-
Myrmicinae	*Cardiocondyla wroughtonii* (Forel, 1890)	Repeated	+	-	-	+
Myrmicinae	*Carebara affinis* (Jerdon, 1851)	Rare	-	-	-	+
Myrmicinae	*Crematogaster flava* Forel, 1886	Common	+	+	+	+
Myrmicinae	*Crematogaster rogenhoferi* Mayr, 1879	Rare	-	+	-	-
Myrmicinae	*Crematogaster travancorensis* Forel, 1902	Rare	-	-	-	+
Myrmicinae	*Lophomyrmex birmanus* Emery, 1893 (Figure 18)	Common (FRWB)	+	+	+	+
Myrmicinae	*Meranoplus bicolor* (Guerin-Meneville, 1844)	Common	+	+	+	+
Myrmicinae	*Monomorium atomum* Forel, 1902	Rare	-	-	+	-
Myrmicinae	*Monomorium dichroum* Forel, 1902	Rare	-	-	-	+
Myrmicinae	*Monomorium floricola* (Jerdon, 1851)	Repeated	-	-	+	+
Myrmicinae	*Monomorium monomorium* Bolton, 1987	Rare	-	-	-	+
Myrmicinae	*Monomorium orientale* Mayr, 1879	Repeated	+	-	+	-
Myrmicinae	*Myrmicaria brunnea* Saunders, 1842	Repeated	-	-	+	+
Myrmicinae	*Pheidole indica* Mayr, 1879	Rare	-	+	-	-
Myrmicinae	*Pheidole parva* Mayr, 1865	Rare	-	-	-	+
Myrmicinae	*Pheidole* sp1.	Rare	-	+	-	-
Myrmicinae	*Pheidole* sp2.	Repeated	-	+	-	+
Myrmicinae	*Recurvidris recurvispinosa (Forel, 1890) (Figure 14)*	Repeated	-	+	+	-

Subfamily	Ant species	Occurrence	Pre-monsoon	Monsoon	Post-monsoon	Winter
Myrmicinae	*Solenopsis geminata* (Fabricius, 1804)	Repeated	-	-	+	+
Myrmicinae	*Temnothorax schurri (Forel, 1902) (Figures 6-8)*	Rare (FRWB)	-	-	+	-
Myrmicinae	*Tetramorium obesum* Andre, 1887	Repeated	+	-	+	-
Myrmicinae	*Tetramorium walshi* (Forel, 1890)	Rare	-	+	-	-
Myrmicinae	*Trichomyrmex scabriceps* (Mayr, 1879)	Common	+	+	+	+
Ponerinae	*Bothroponera sulcata* (Mayr, 1867)	Repeated	-	+	+	-
Ponerinae	*Brachyponera jerdonii* (Forel, 1900)	Common	+	+	+	+
Ponerinae	*Diacamma indicum* Santschi, 1920	Common	+	+	+	+
Ponerinae	*Leptogenys chinensis* (Mayr, 1870)	Repeated	-	-	+	+
Ponerinae	*Leptogenys hysterica* Forel, 1900 (Figures 9-11)	Rare (FRWB)	-	-	-	+
Ponerinae	*Platythyrea parallela* (Smith, 1859) (Figure 12)	Rare	-	-	+	-
Ponerinae	*Pseudoneoponera rufipes* (Jerdon, 1851)	Repeated	-	+	+	-
Pseudomyrmecinae	*Tetraponera aitkenii* (Forel, 1902) (Figures 3-5)	Rare (FRWB)	-	+	-	-
Pseudomyrmecinae	*Tetraponera nigra* (Jerdon, 1851)	Rare	-	-	-	+
Pseudomyrmecinae	*Tetraponera rufonigra* (Jerdon, 1851)	Common	+	+	+	+
			20	24	34	33

scabriceps (Mayr, 1879), mutualists: *Lophomyrmex birmanus* all coexist in this area. So, different kinds of associations and interactions were found within a small area, which shows even though the area is disturbed by regular anthropogenic activities, vehicular pollution and pesticides, it provides suitable microhabitats for ground foragers as well as arboreal ants.

Acknowledgements

The authors are thankful to the Director, Zoological Survey of India, Kolkata for providing all necessary help and support. They are immensely grateful to the authority and staff members of the Agri Horticultural Society of India and especially to Mr. Sandip Saha, Secretary and Dr. Koushik Dutta, Assistant Secretary for permitting the study and all co-operations extended for this study. The help and support by Sri Arnab Mandi, Central Entomology Laboratory, Zoological Survey of India, Kolkata is greatly acknowledged here. The first author is grateful to Dr. Arijit Chatterjee, Faculty of Department of Environmental Science, Asutosh College, Dr. Swarnali Mukherjee, Assistant Professor of Raghunathpur college and Dr. Longjam Roni Kumar Singh, PDRF, Central Entomology Laboratory, for their guidance and she is also indebted to the Council of Scientific & Industrial Research for providing financial assistance for conducting research as a part of NET-JRF fellowship programme.

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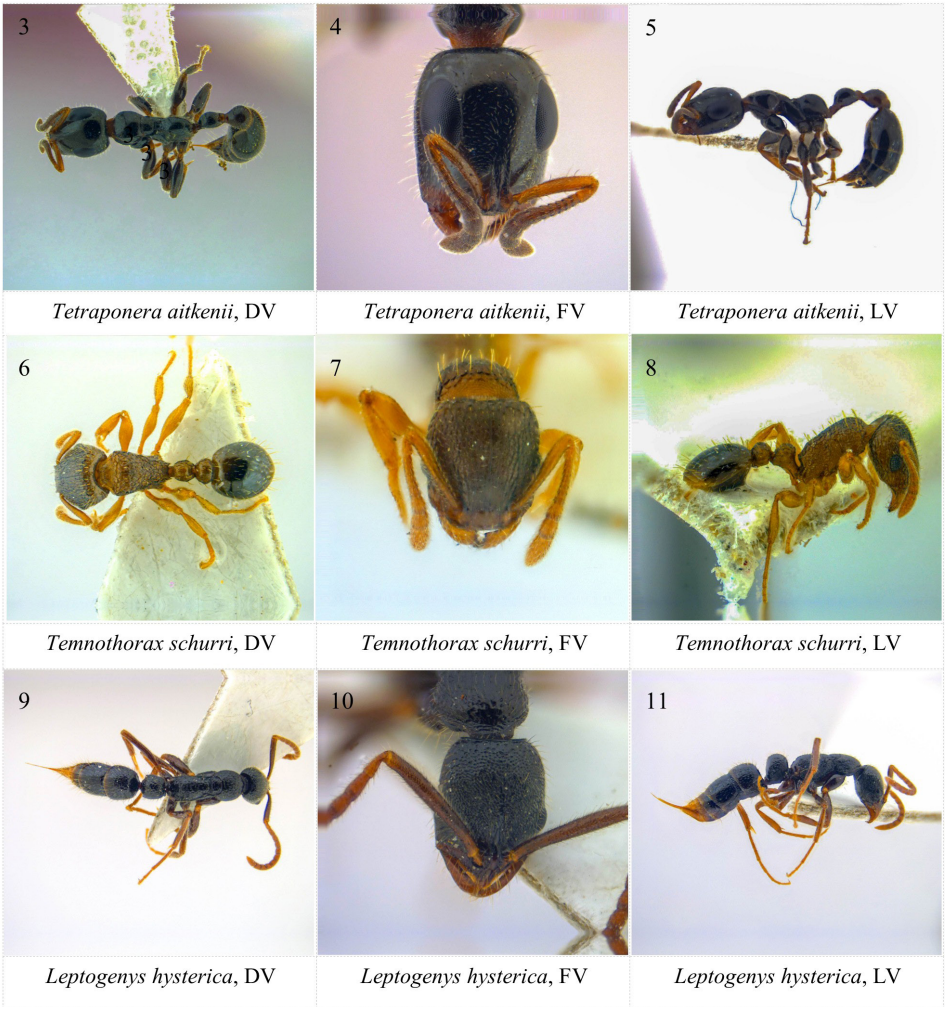
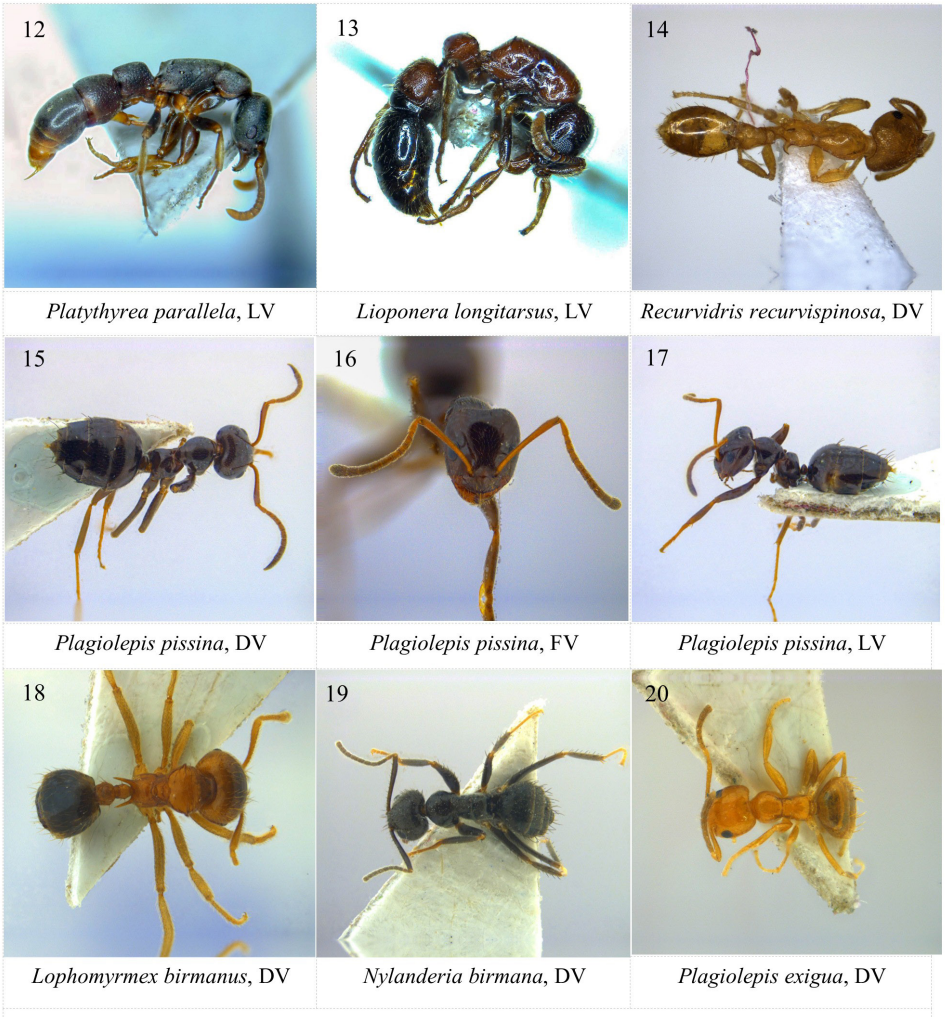


Figures 3-11. Ants collected from Agri-Horticultural Society of India, Kolkata. LV = lateral view, FV = frontal view, DV = dorsal view.



Figures 12-20. Ants collected from Agri-Horticultural Society of India, Kolkata. LV = lateral view, FV = frontal view, DV - dorsal view.